Testimony of Deron Lovaas, NRDC Vehicles Campaign Director
Assessing Progress in Advanced Technologies for Vehicles and Fuels
Committee on Science of the U.S. House of Representatives
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"America is addicted to oil," the President said in his State of the Union. He was right. We're hooked. Why is that the case?

Transportation drives our addiction. For starters, we're taking more trips. More Americans rode trains and buses 80 years ago, and transit use spiked during World War II. Then it plummeted, leveling off at less than half of its peak level. Meanwhile vehicle miles traveled climbed steadily, and are at the three trillion per year mark.[1]

Increasing travel by private vehicle is exacerbated by two other trends: An increasingly wasteful fleet of cars and trucks and pitifully small use of alternatives to fuels made from oil.

Thanks largely to the proliferation of larger vehicles – particularly SUVs – improvements in fuel economy of the fleet stalled in 1988. The largest recent jump in performance happened in the late 70s, driven by policy and consumer choices in reaction to embargoes and price runups.[2]

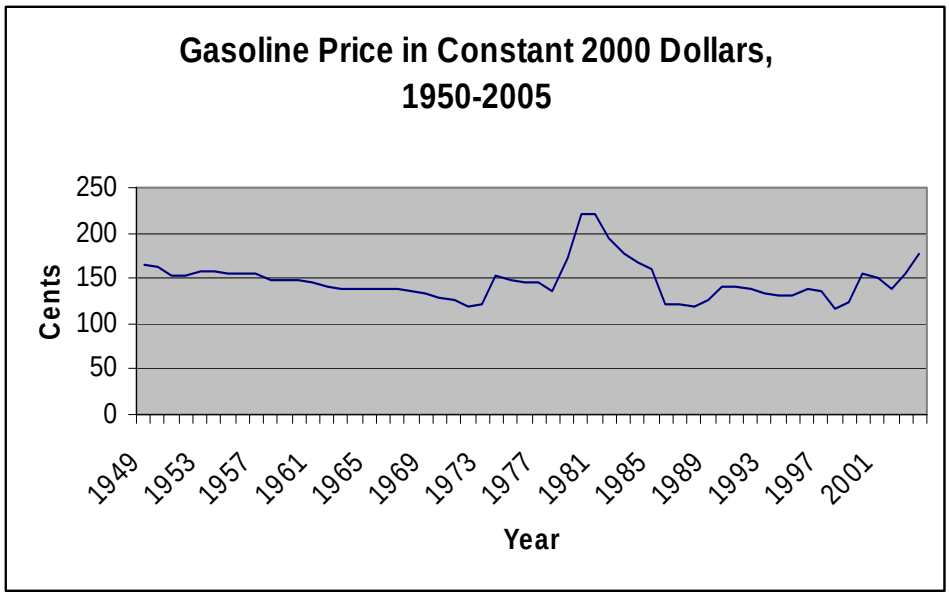
The third factor is alternative fuel use, or rather non-use, in transportation. We fill our tanks with fuel, and 97% of the time it's a petroleum-derived liquid, mostly gasoline.

Meanwhile, domestic production peaked and has been declining steadily since 1970. Currently, we produce about 8.9 million barrels a day but that's only enough to meet about 40% of America's daily consumption of 21 million barrels daily.[3]

The Oil Price Roller Coaster

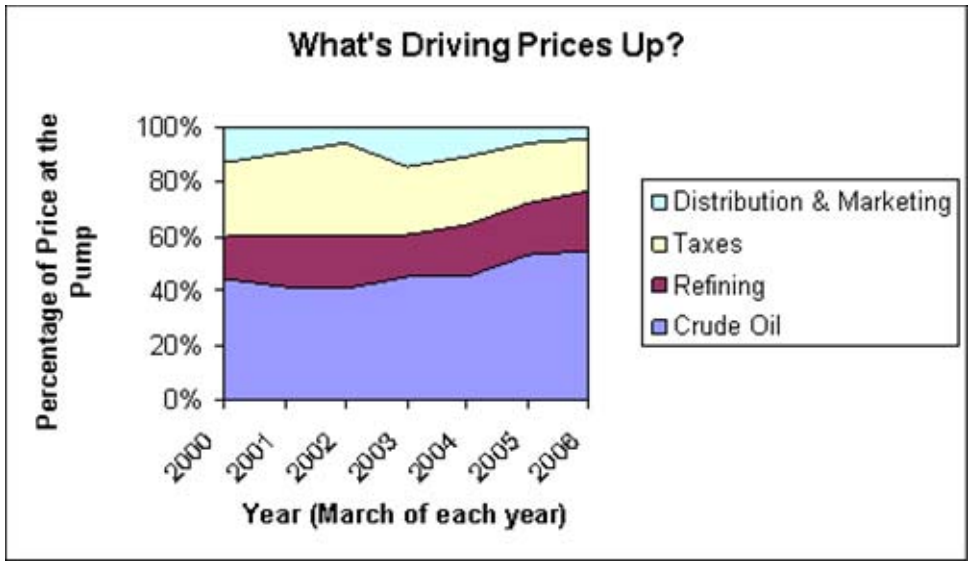
Not since the embargo and marketplace turmoil in the 1970s have prices increased as much as in the early 2000s. In fact, gasoline prices are approaching all-time highs (see graph below).

[1] Based on Federal Highway Administration and American Public Transportation Association figures
[2] U.S. EPA, "Light-Duty Automobile Technology and Fuel Economy Trends: 1975 Through 2003"
[3] Energy Information Administration (EIA), Department of Energy



Source: EIA

Underpinning soaring prices are the oil markets, as shown in the graph below.



Source: EIA

The fundamentals underpinning the oil price trends are described in a recent report by NRDC, the Office for the Study of Automotive Transportation and the University of Michigan Transportation Research Institute:[4]

> Most analysts agree that market fundamentals of high demand and limited supply, and not speculation or market hysteria, are the primary reason for today's high oil prices. These prices can be explained, in part, by explosive growth in oil demand, especially from China. Oil demand has grown a robust 5 percent since 2003, despite a doubling of

[4] "In the Tank: How Oil Prices Threaten Automakers' Profits and Jobs," July 2005.

> oil prices during that period. It appears likely that increased global oil demand and tight global oil supplies will keep fuel prices high for the next several years.
>
> There is little spare oil production capacity to cushion a sudden loss in supply and the mix of easily extractable crude oil is moving away from "light, sweet" toward more "sour" grades that fewer refineries can handle. Considering these factors, oil prices may abruptly jump even higher, as happened during the first two oil crises of 1973–75 and 1979–81. But unlike these last two oil crises, important oil market fundamentals could favor a higher price lasting for much longer—and perhaps becoming a permanent feature of the environment.
>
> One reason we can expect sustained high oil prices is that we have limited spare capacity. Historically, producers were accused of holding back supplies when prices rose. But most industry experts agree that the Organization of the Petroleum-Exporting Countries (OPEC) and other suppliers are now pumping at or near the upper limits of their capability. Indeed, there are concerns that rapid exploitation degrades the longterm viability of some oil fields.[5] Spare capacity, often used to cushion oil price spikes, is essentially gone.

The Energy Information Administration (EIA) confirmed that high prices are here to stay in the Annual Energy Outlook 2006 (AEO 2006). The reference case projects that oil prices will drop from the $60-70 levels of recent months to $47 in 2014, only to increase to $54 per barrel – $21 higher than the 2005 outlook -- in 2025. And the high price case actually flirts with the $100 per barrel level in 2030.[6]

Déjà vu All Over Again: Prices Affecting Auto Sales

Of course, price fluctuations are not a new thing. The last time oil prices leapt to this level the effect was profound, as described again in the "In the Tank" report:

> [D]rivers also began shunning large, gas guzzling cars made by American automakers in favor of fuel-efficient cars built in Japan and Germany. Between 1978 and 1981, U.S. automaker sales dropped by 40 percent, a decline of about 5.2 million units.[7] The second oil shock came six years after the first shock, which Congress in 1975 to adopt fuel economy standards (under the Energy Policy and Conservation Act of 1975, known as "EPCA"). This law required a doubling in passenger car efficiency to 27.5 mpg between and 1985. Some argue that the U.S. Big Three's share loss in this period would have been even worse had they not been forced to begin building least some more fuel-efficient cars to comply with the new law.

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[5] Simmons, Matt. *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy,* John Wiley & Sons (2005).

[6] EIA, AEO 2006

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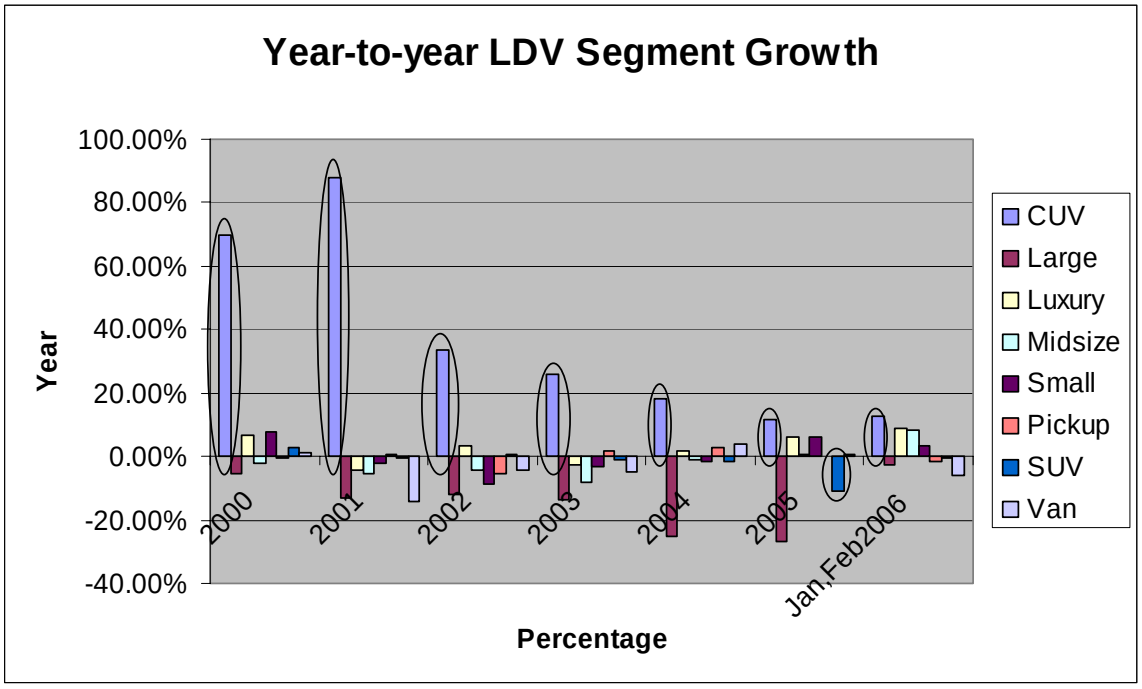
> Employment plunged along with automobile sales. It dropped 30 percent from 1978 to 1982, for a total loss of more than 300,000 jobs in direct auto and part manufacturing jobs—and even more jobs were lost if auto-related jobs are considered.22 And the Detroit Big Three suffered record losses. In 1980, GM lost $762 million, Ford lost $1.7 billion, and Chrysler lost the most, $1.8 billion. Chrysler's situation was so bad that in 1979 Congress agreed to bail out the company with $1 billion in loan guarantees.[8]
>
> Worse, when gasoline prices returned to preshock levels, U.S. automakers failed to regain their lost market share in passenger cars. Indeed, the three periods of sharpest growth in import market share, 1973–75, 1979–81, and 2003–present, coincide precisely with the largest increases in per-gallon gasoline prices.

History is beginning to repeat itself. On the one hand, sales of larger vehicles, like the overall economy, have been remarkably resilient in the face of high prices: In 2003, the share of sales for large light-duty vehicles was 73.3% and it edged down slightly to 73.1% in 2005.[9]

But slicing the data more finely yields a fundamental shift in auto sales. Based on data from the Planning Edge, the graph below shows tremendous growth in the crossover utility vehicle segment, while large SUV sales took a hit in 2005.



And while they only account for 1-2% of total U.S. sales, the other trend that has received a great deal of press attention is soaring sales of hybrid-electric vehicles. In fact, hybrid sales have doubled or nearly so every year since the turn of the century:

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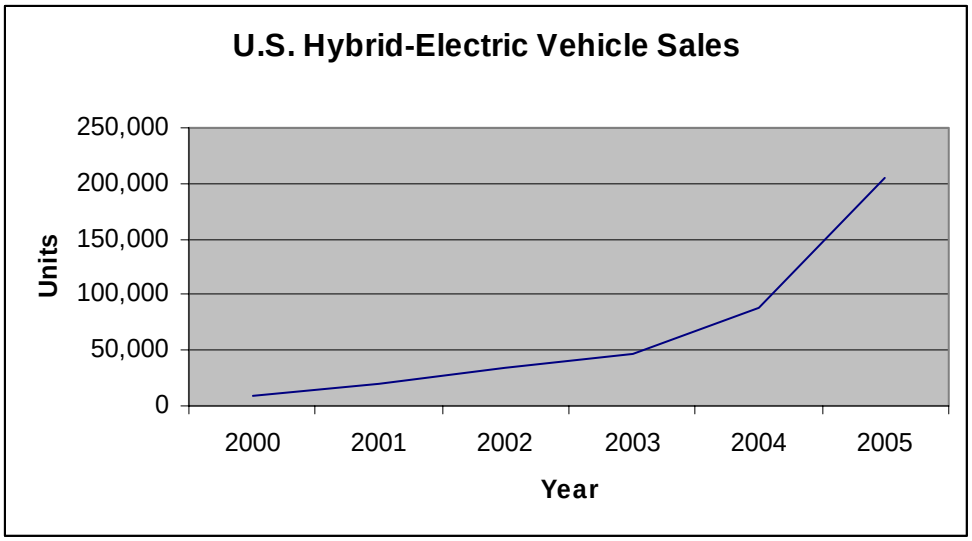
[8] Doyle, J., *Taken for a Ride*, the Tides Center, 2000, p. 173–4.
[9] Ward's Automotive Reports, 2003-2006, monthly.

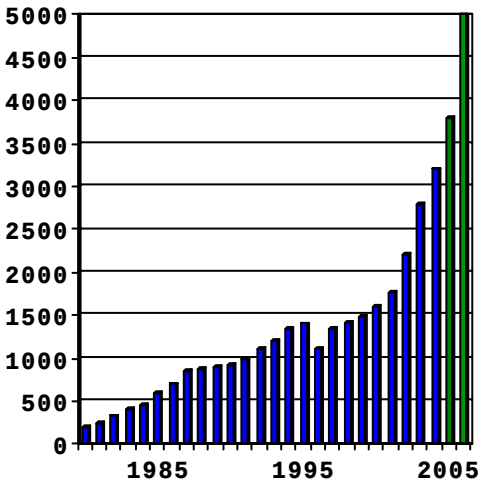


Source: Business Week Online

Biofuels

Biofuels are liquid, alcohol fuels derived from plant matter. The U.S. primarily uses ethanol using corn as a feedshock. While our transportation sector is 97% dependent on petroleum-derived fuels – especially gasoline – ethanol makes up for the remainder.

And it has been growing rapidly, as shown by the chart below (in millions of gallons per year of corn ethanol):



Source: Renewable Fuels Association and the American Council on Renewable Energy

Beyond corn, the next generation of biofuels is being developed. Specifically, ethanol derived from the cellulose of plants offers promise. The President referred to this emerging technology in his 2006 State of the Union speech when he talked of making ethanol from switchgrass. As explained in the NRDC report “Growing Energy”:

> Cellulosic biomass is basically all the parts of a plant that are above ground except for the fruit and seeds, such as corn, wheat, soybeans, and rapeseed. Technically, cellulosic biomass is the photosynthetic and structural parts of plant matter. Other examples of cellulosic biomass include grass, wood, and residues from agriculture or the forest products industry. Most forms of cellulosic biomass are composed of carbohydrates, or sugars, and lignin, with lesser amounts of protein, ash, and minor organic components. The carbohydrates, usually about two-thirds of the mass of the plant, are present as cellulose and hemicellulose—thus the term cellulosic biomass.[10]

Advantage of this process and its reliance on feedstocks besides corn include dramatic increases in energy and environmental benefits, including big reductions in carbon dioxide emissions.

Heartening Trends, But Slow Progress Overall

In percentage terms trends in hybrids and biofuels are impressive. But in absolute terms they barely make a dent in our oil addiction. A higher price plateau notwithstanding, current demand of about 21 million barrels per day is projected to increase by more than a third by 2030.[11]

This has serious economic consequences. First, we're already transferring a huge amount of wealth overseas thanks to a ballooning trade deficit. The economic costs would be steeper, if not for the fact that our policy response to the energy crisis in the 70s helped to drive the oil intensity (a measure of barrels used to produce GDP) of our economy down by about one-third, providing better insulation from today's high prices. This is why demand has barely slackened and the economy hasn't slipped into recession.

However, these gains have slowed dramatically in recent years. It's clear why this is so in transportation – stagnating fuel economy and increasing travel. For electricity, it's due to the fact that there's just not much left to shift – we have pretty much weaned that sector off oil. This means that our economic shock absorbers are wearing thin once more.

Spiky, high prices have been a hardship for U.S. consumers, but the pain is more deeply felt in the developing world. According to the World Bank, a sustained oil-price increase of $10 per barrel will reduce GDP by an average of about 1.5% in countries with per-capita income of less than $300, compared to a loss of less than .5% for developed countries.

And of course the consequences for national security are alarming too, as described a joint NRDC-Institute for the Analysis of Global Security report "Securing America: Solving Our Oil Dependence Through Innovation" (attached).

Breaking the Oil Addiction Requires New Policies

Policymakers must provide frustrated consumers with a means to react to persistent price signals. Thankfully, this doesn't require a 12-step program. It does require significant policy reforms.

Many of the necessary reforms are included in a bill supported by the Set America Free coalition. H.R. 4409, the Fuel Choices for American Security Act, currently has 75 cosponsors and has four components:

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[10] Greene, et al., "Growing Energy: How Biofuels Can Help End America's Oil Dependence," December 2004.

[11] EIA AEO 2006

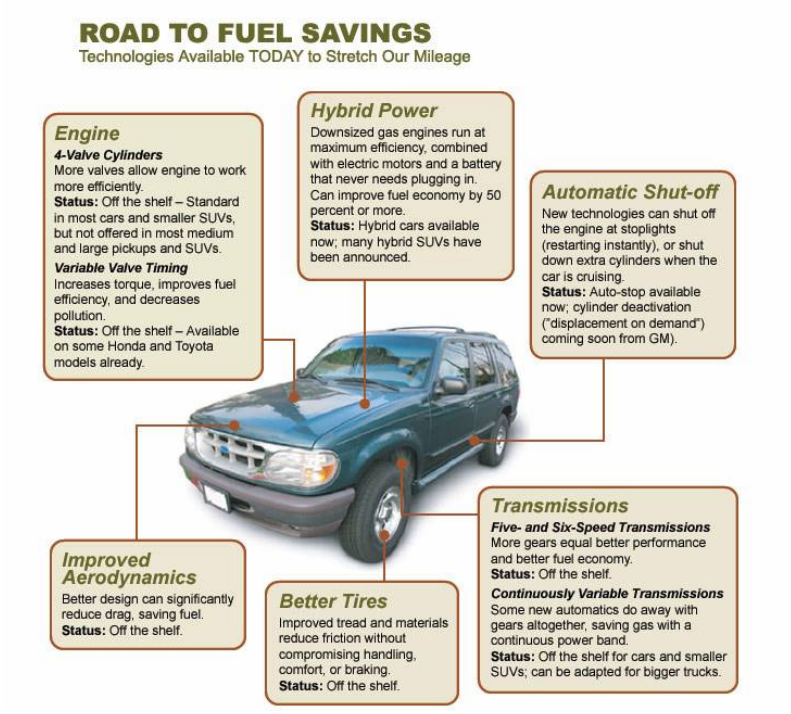
- A national oil savings requirement starting at 2.5 million barrels of oil per day within ten years and increasing over time, achieved through a menu of existing and new authorities and incentives;
- federal manufacturer retooling incentives for production of efficient vehicles and authority to set efficiency standards for tires and heavy duty trucks;
- programs that increase fuel choice in the transportation sector; and
- a national energy security media campaign to educate the public about oil dependence.

The targets can be achieved via oil savings from any sector, any technology. Much of the savings will come from transportation, which is responsible for about two-thirds of our oil consumption and is utterly dependent on petroleum.

Overview of Technologies

There are a variety of options available to reduce our oil dependence. Some of the advantages and challenges posed by each one are summarized below.

- Off-the-shelf improvements to conventional vehicles: As summarized in the graphic below from NRDC's web site, these include improvements such as 4-valve cylinders, variable valve timing, automatic engine shut-off, slicker materials for reduced drag, better tires and five- and six-speed transmissions. The Union of Concerned Scientists has calculated that making similar improvements to an average SUV yields at least a 31% improvement in fuel economy performance.[12]



[12] Union of Concerned Scientists, "Building a Better SUV," http://www.ucsusa.org/clean_vehicles/cars_pickups_suvs/building-a-better-suv.html

- Hybrid-Electric Vehicles (HEVs): These increasingly popular cars and trucks are fueled by electricity and/or gasoline. They run the gamut from mild hybrid models (for example, Chevrolet Silverado comes in a hybrid version) to full ones (Toyota Prius). Although costs of the technology have come down since the first hybrid was introduced in 1999 by Honda (the Insight, now discontinued), and prices of gasoline have come up, these fuel-sippers are still a relatively costly proposition for consumers.

  Consumer Reports recently analyzed five-year costs (purchase, sales tax, insurance, maintenance, financing) and benefits (federal tax credits, lower fuel costs, higher resale value) of five hybrids and found that only two penciled out, barely: The Toyota Prius and the Honda Civic. Their analysis assumed gas prices rising over time to $4 per gallon.[13]

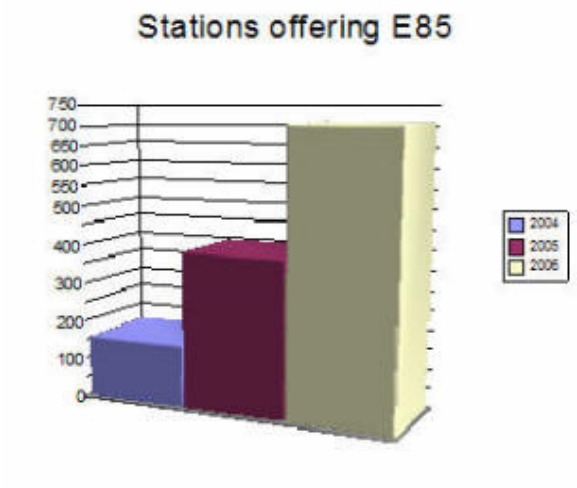
  On the other hand, a recent Consumer Federation of America report found that a threshold has been crossed with $3 per gallon gasoline. Their analysis shows that consumers no longer pay a premium for efficiency. Opting for a more efficient technologies including hybrid-electric engines should be "cash-flow neutral" for consumers, according to this analysis.[14]

- Flexibly-Fueled Vehicles (FFVs): These vehicles are capable of running on a mixture mixture of alcohol fuels such as ethanol and gasoline. This adds some expense to the manufacture of automobiles, specifically to ensure that tanks and fuel hoses are able to tolerate alcohol. One estimate places per-vehicle cost at a modest $100-200.[15]
  There are other challenges with displacement of gasoline with ethanol. When blended in low proportions to gasoline, smog-forming pollution (oxides of nitrogen and volatile organic compounds) increases compared to gasoline. Higher blends such as E85 (85% ethanol, 15% gasoline) yield a cleaner-burning fuel.

  Another drawback of ethanol is its lower energy content compared to gasoline. Due to the difference, for ethanol to be a cost effective alternative it must be at least 25% cheaper than gasoline.

  Last but not least is the chicken-and-egg problem with this fuel: Precious few stations feature ethanol pumps. This is changing rapidly (see graph below) and resources for locating pumps are readily available (see http://afdcmap2.nrel.gov/locator/FindPane.asp). But the 710 stations currently offering this choice adds up to less than .5% of the total number of retail outlets.[16]

[13] Consumer Reports, April 2006, "The Dollars and Sense of Hybrids."
[14] Cooper, Mark, "50 by 2030: Why $3.00 Gasoline Makes the 50 Mile per Gallon Car Feasible, Affordable and Economic," May 2006.
[15] "Ethanol Fact Sheet," American Petroleum Institute, March 23, 2006.
[16] According to the National Petroleum News (May 2005) as quoted by EIA there are 168,987 gas stations in the U.S.



Source: http://e85vehicles.com/

- Plug-In Hybrid Electric Vehicles (PHEVs): These are vehicles which rely more heavily on electricity as a fuel, although they can also run on gasoline, or a blend of alcohol fuel and gasoline. Although Honda and Toyota remain skeptical due to marketing concerns (awareness has only recently become widespread that hybrids DON'T have to be plugged in), there is growing interest in these vehicles as a tool for breaking the oil habit. Significant challenges remain, however.

  First among these is battery technology. Batteries remain expensive and have limited ranges. So in spite of cost savings due to a smaller internal combustion engine and electrification of other vehicle components too, while an HEV might cost $2500-4000 more than a similar conventional vehicle, a PHEV with a range of 20 miles would cost $4000-6,000 and one with a range of 60 miles would cost $7400-$10,000.[17]

  Range may not be a troubling issue, since 31-39% of annual miles driven are the "first 20 miles" of daily driving.[18] Therefore, the daily needs of many drivers would be satisfied with this range.

  PHEVs would also save a great deal of fuel. One estimate found that while a conventional vehicle uses 523 gallons per year and a HEV uses 378, a PHEV with a 20 mile range would use 219. And a PHEV with a 60 mile range would use a miniscule 83 gallons annually.[19]

  There are other advantages to PHEVs. They don't suffer from the chicken-and-egg problems that plague biofuels and hydrogen, since an electrical grid already exists.[20] If charged at homes at night, they would make use of surplus, off-peak electricity. And so

[17] EPRI, 2001 as quoted in Plotkin, Steven, "Grid-Connected Hybrids: Another Option in the Search to Replace Gasoline," TRB 2006 Annual Meeting.
[18] 1997 Nationwide Personal Transportation Survey, U.S. DOT, as quoted in Plotkin, Steven, "Grid-Connected Hybrids: Another Option in the Search to Replace Gasoline," TRB 2006 Annual Meeting.
[19] Plotkin, Steven, "Grid-Connected Hybrids: Another Option in the Search to Replace Gasoline," TRB 2006 Annual Meeting.
[20] Luft, Gal, **"**Plug in for America: California should encourage electric cars**,"** San Francisco Chronicle, May 26, 2006.

long as the grid is powered by relatively clean fuels – such as natural gas, hydroelectric, wind or solar – air pollution would also be reduced.[21]

- Transit Use: In urban areas, providing alternatives to driving is another viable tool for curbing oil use. According to the American Public Transportation Association, public transportation now saves us almost 125,000 barrels of oil a day. But if we increased reliance on public transportation to, say, the level of our neighbors in Canada, we would save more oil than we import from Saudi Arabia every six months.

Conclusion

Breaking our addiction, as the President called it, is a tremendous challenge. The costs to our security, our economy and our environment are terribly high. We meet this threat head-on, with similar determination that drove us to win World War II and to put a man on the moon.

Fortunately we don't have to invent the key to our oil-soaked shackles. The technology exists, and the costs are coming down, especially in relation to the price of fuel.

To set America free, all of the technologies described above deserve greater investment and deployment. Consumers will appreciate the choice, and cumulative effects are likely to be great. For example, envision a more efficient car – whether a conventional vehicle with off-the-shelf improvements, an HEV, or a PHEV – that is also capable of running on E85. This could yield hundreds of miles per gallon of gasoline, as some have claimed.[22]

One of the best ways to put us on the path to energy security is to enact H.R. 4409, the "Fuel Choices for American Security Act" sponsored by Representatives Kingston, Engel and Saxton. This bill specifies specific ends – oil-savings of 2.5 million barrels per day in 2015 and 5 million barrels per day in 2025 – and provides a host of means to achieve them It doesn't pick winners, but gives a boost to the various technologies described above. I urge you to support it.

Thank you for your time and interest.

[21] Plotkin, Steven, "Grid-Connected Hybrids: Another Option in the Search to Replace Gasoline," TRB 2006 Annual Meeting.
[22] Zakaria, Fareed, "Imagine: 500 miles per gallon," Newsweek, March 7, 2005.